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# Natufian Hunter-Gatherers Fishing Strategies: The Early Appearance of the Fishhooks in the Near East and Their Significance

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## ABSTRACT

Fish are a prominent source of nutrients, yet in the southern Levant, clear evidence for fishing was scarce before the historic periods. In the current paper, we present the evidence for Natufian (ca. 15,000–11,700 cal BP) fishing with an emphasis on fishhooks, representing one of the best examples of an artefact that reached its morphological optimum thousands of years ago and continued to be widely used today. While fishing using various techniques and implements was probably in use well before the Natufian, this innovation seems to represent a new technique, more restricted and controlled, for obtaining this food source.

## Estrategias de pesca de cazadores-recolectores natufenses: la aparición temprana de anzuelos en el Cercano Oriente y su importancia

### RESUMEN

El pescado es una importante fuente de nutrientes, aunque la evidencia clara de pesca antes de períodos históricos en el Levante meridional escaseaba. En este artículo, presentamos evidencia de pesca Natufiense (ca. 15,000–11,700 cal AP) haciendo hincapié en anzuelos, que representan uno de los mejores ejemplos de un artefacto que alcanzó su óptimo morfológico hace miles de años atrás y que continúa siendo usado ampliamente en la actualidad. Aunque es probable que la pesca con diversas técnicas e implementos de pesca estuviera vigente antes del Natufiense, esta innovación parece representar una nueva técnica, más restringida y controlada, para obtener esta fuente de alimento.

## 纳图夫狩猎采集者的捕鱼策略：鱼钩在近东的早期形态及其意义

### 摘要

鱼类是一个重要的营养来源，然而在黎凡特南部，在历史时期之前很少有捕鱼的确切证据。本文介绍了纳图夫人（距今约15000–11700）捕鱼的证据，重点是鱼钩，它代表了数千年前达到其最佳形态后并被继续广泛使用至今的人工制品的最佳范例之一。虽然使用各种技术和工具的捕鱼方式可能在纳图夫时代之前就已使用，但这种创新似乎代表了一种新的更可限并受控的技术以获得这种食物来源。

## 納圖夫狩獵采集者的捕魚策略：魚鉤在近東的早期形態及其意義

### 摘要

魚類是一個重要的營養來源，然而在黎凡特南部，在歷史時期之前很少有捕魚的明確證據。本文介紹了納圖夫人（距今約15000–11700）捕魚的證據，重點是魚鉤，它代表了數千年前達到其最佳形態後並被繼續廣泛使用至今的人工製品的最佳範例之一。雖然使用各種技術和工具的捕魚方式可能在納圖夫時代之前就已使用，但這種創新似乎代表了一種新的更可限並受控的技術以獲得這種食物來源。

## استراتيجيات الصيد للصيد النطوفيين: الظهور المبكر للخفافات في الشرق الأدنى وأهميتها

### المستخلص

تعتبر الأسماك مصدرًا بارزًا للمغذيات ولكن كانت الأدلة الواضحة على الصيد في جنوب بلاد الشام نادرة قبل الفترات التاريخية. يقدم هذا المقال الدليل على صيد النطوفيين (حوالي 15000–11700 قبل الوقت الحاضر) مع التركيز على الخفافات والتي تمثل أحد أفضل الأمثلة على القطع الأثرية التي وصلت إلى الحد المورفولوجي الأمثل منذ آلاف السنين واستمر استخدامها على نطاق واسع حتى يومنا هذا. وفي حين أن الصيد باستخدام تقنيات وأدوات مختلفة كان قيد الاستخدام على الأرجح قبل العصر النطوفي إلا أنه يبدو أن هذا الابتكار يمثل تقنية جديدة أكثر تقييدًا وخاضعًا للسيطرة وذلك للحصول على مصدر الغذاء هذا.

## KEYWORDS

Natufian; hunter-gatherers; fishing; fishhooks; Epipalaeolithic; southern Levant

## PALABRAS CLAVE

Natufiense; cazadores-recolectores; pesca; anzuelos; Epipaleolítico; Levante meridional

## 关键词

纳图夫人; 狩猎采集者; 捕鱼; 鱼钩; 后旧石器时代; 黎凡特南部

## 關鍵詞

納圖夫人; 狩獵采集者; 捕魚; 魚鉤; 後舊石器時代; 黎凡特南部

## الكلمات الدلالية

النطوفيين  
الصيدون  
الصيد  
الخفافات  
الإيباليوليت  
جنوب بلاد الشام

Aquatic resource exploitation and fishing were probably practiced by humans well before evidence appeared in the archaeological record (e.g. Álvarez-Fernández, 2015; Conard et al., 2013, pp. 185–187; Guillaud et al., 2021) and used as a means to acquire stable sources of proteins and expand the diet. Nonetheless, we have limited data regarding early fishing technologies and the know-how pertaining to fishing strategies which control the yields (especially the number of fish). It is clear, however, that through time, fishing became increasingly important in some areas of the world. This significance advanced and promoted various technological developments to increase fishing reliability and control over the catch. Fishing comprises numerous techniques, including some that aim at a single catch (e.g. angling) and others that generate a larger catch (e.g. using nets, traps and poisoning). This dichotomy is noteworthy as it touches upon the basic ways hunters-gatherers sustain their environment and allow their ecosystem to regenerate. The chosen method is also influenced by the fish one desires to target and by the different habitats and terrains where fish thrive.

Early evidence for fishing and fish processing (O'Connor et al., 2011) comes from different sources. For example, fishing and fish processing was supported at the Neanderthal site of Payre in the Ardèche, France (approximately 250,000–125,000 years ago, see Hardy & Moncel, 2011) based on residue and use-wear analysis of lithics, and deep sea fishing was noted based on the ichthyofaunal remains at East Timor around 42,000 BP (O'Connor et al., 2011).

In the Near East, fish remains and evidence of fishing also have a long history. Fish remains were recovered as far back as the Lower Palaeolithic (e.g. Zohar et al., 2014; Zohar & Biton, 2011) and they are continuously recovered at prehistoric sites in varying frequency (van Neer et al., 2005). Evidence for fishing gear is dated to *ca.* 23,000 years ago, in the form of notched stone weights (net sinkers) used in line or net fishing and selected exploitation of specific species (Nadel & Zaidner, 2002; Rosenberg et al., 2016; Zohar, 2003; Zohar et al., 2018). These net sinkers continued to appear at least until the Early Bronze Age (Rosenberg et al., 2016), and parallels are known from ethnographic documentation (Altman & Ebrary, 2006, pp. 38–39; Potts, 2012, pp. 226–227; Rau, 1884, p. 156; Rosenberg et al., 2016; Sandelowski, 1970; Smith, 1910, pp. 30–31). These weights hint at the use of nets and thus reflect the aim to catch large numbers of fish in each fishing session. Further evidence is noted by fish remains and specialized fishing gear during the Neolithic, including notched and perforated weights, spearheads or spear points, and rarely hooks (Galili et al., 2002; 2004; 2013; Potts, 2012, pp. 226–227; Rosenberg et al., 2016; van Neer et al., 2005). Fish hooks are well-known

worldwide, and while currently are made of various metals, in the past, bone and shells were the prime raw materials used for the production of fish hooks (see e.g. Hurum, 1977 and also Mery et al., 2008).

The first advance in fishing technology that aimed at a selective catch of a single fish is the J-shaped fishhook. Notably, it appeared contemporaneously in several locations. Hooks appeared for the first time at Jerimalai shelter, East Timor dated to *ca.* 23,000–16,000 years ago (O'Connor et al., 2011, fig. 3). In Europe fishhooks appeared at *ca.* 12,300 BP based on six fishhooks found at the Final Palaeolithic site of Wustermark 22 in northeastern Germany (Gramsch et al., 2013). Other Final Palaeolithic sites in Europe also produced fishhooks, and these continued to be found commonly during the Mesolithic (see Gramsch et al., 2013 and references therein). In the Levant, well-designed bone fishhooks appeared for the first time at *ca.* 15,000–11,700 cal BP, associated with the Natufian culture of the Epipalaeolithic (Boyd, 2012, p. 359; Campana, 1989, pp. 101–102; 2007; Marder et al., 2013; Nadel et al., 2008, 2012; Pedergnana et al., 2021; Valla et al., 2004).

The Natufian culture of the Levant (*ca.* 15,000–11,700 cal BP), represented sedentary hunter-gatherer groups on the threshold of agriculture, notable for their relatively large hamlets, durable stone architecture (e.g. Bar-Yosef, 1983; Belfer-Cohen & Bar-Yosef, 2002; Henry, 1989; Perrot, 1966), rich material culture repertoire, economic and social intensification, commensal animals, cemeteries and elaborate burial customs (e.g. Bar-Yosef, 1983, 1998; Belfer-Cohen, 1991; Garrod, 1932; 1957; Goring-Morris & Belfer-Cohen, 2008; Henry, 1995; Tchernov, 1984; Valla, 1995; Wright, 1978). Natufian communities exploited a wide variety of coastal and inland areas, mainly in the Mediterranean eco-zone. They usually exploited resources deriving from the immediate vicinity of the site, indicating intensive exploitation of spatially limited territories (Munro, 2004, 2009; Yeshurun & Bar-Oz, 2018). This widely discussed Natufian 'broad spectrum' economy (Flannery, 1969) was the result of external and internal pressures such as environmental stress and population pressure (see also discussions in Edwards, 1989; Munro, 2004; Stiner, 2001). Among the many changes that characterized the Natufian culture, notable advances were made in food acquisition and processing. This was noted in possible hunting gear (Yaroshevich et al., 2010), harvesting and threshing equipment and fishing gear.

While Natufian hunting and harvesting implements were widely discussed in the past and their characteristics are well known, Natufian fishing gear hardly entered archaeological discourse, although possible fishing-related artefacts and fish remains were known from excavated sites for decades (e.g. Saxon, 1974; Turville-Petre, 1932). Natufian fishing is

reflected by various aspects, including fish remains (e.g. Bar-Yosef Mayer & Zohar, 2010), material culture (e.g. Bar-Yosef, 1998; Campana, 1989; Pedergrana et al., 2021; Rosenberg et al., 2016) and even artistic representations (Belfer-Cohen, 1991, p. 578, fig. 9).

Natufian fishing may have encompassed a variety of techniques such as trapping, poisoning, hand catching, spearing and line fishing; however, only a small portion of the related fishing equipment survived, including stone notched fishing weights (Perrot, 1966; Valla et al., 1998 and see also Moore et al., 1975, figs. 5:38–5.39), bone gorges and ‘harpoons’ (e.g. Belfer-Cohen, 1988, p. 188, figs. IV-3:4–IV-3:5; Campana, 1989, pp. 47–50, pl. 27; Kenyon, 1960, pl. XVb; Nadel et al., 2008, fig. 43; Turville-Petre, 1932, pl. XXVIII) and bone fishhooks. While some of the suggested fishing gear may have been used for other purposes (e.g. trapping, hunting or as weights for various uses), fishhooks are a clear unifunctional tool that seems to be the best example of the advent of a new form of procurement of aquatic subsistence resources. They represent one of the best examples of an artefact that reached its morphological optimum thousands of years ago and continues to be widely used today all over the world.

In this paper, we explore the case of the early fishhooks in the southern Levant and hypothesize on the cultural and behavioural implications it carries. We argue that while techniques and technologies for catching relatively large numbers of fish (netting, trapping and maybe even poisoning) were probably used by the Natufian hunter-gatherers, the fishhook represents a new mode of food acquisition that offers greater control of the number of fish in each catch. In turn, we suggest that angling reflects a more restricted endeavour to obtain fish (compared with the use of a net or poisoning), which controls the use of specific aquatic resources in the form of sustainable fishing.

### Fish remains at Natufian sites

Many of the Natufian base-camps and hamlets were located near perennial bodies of water: several kilometres east of the Mediterranean Sea, near the Jordan River, the Hula Lake and the Sea of Galilee (Table 1, Figure 1). All of these locations constitute ecological niches with diverse and at least in some cases stable aquatic fauna during the later parts of the Epipalaeolithic (see e.g. Bar-Yosef Mayer & Zohar, 2010; Borvon et al., 2018; Munro et al., 2021; Pedergrana et al., 2021), which in turn provide reliable and beneficial food sources.

However, to date, fish remains have been reported and published for only 12 Natufian sites, usually in very low numbers (Table 1, Figure 1). As retrieval methods do not seem to be responsible for this (as

some of the sites, where intensive fine sieving was practised, also show low numbers of fish bones), we need to consider the possibilities that fish had a minor role in the economy (in comparison to terrestrial resources) of most Natufian sites (Eynan and Jordan River Dureijat and maybe other sites in the Hula Valley are the exceptions to that), that fish were subjected to some sort of a taboo (e.g. Begossi et al., 2004; Simoons, 1974) or that fish were preferred only by specific Natufian groups and that they may have had special status (environmental factors does not seem to explain the low number of fish found). The fish families identified – *Cichlidae*, *Clariidae*, *Cyprinidae*, *Mugilidae*, *Mullidae*, *Salmonoid*, *Sciaenidae*, *Serranidae* and *Sparidae* – indicate that the Natufians drew on both fresh- and saltwater sources. Saltwater fish (*Sciaenidae*, *Serranidae*, *Sparidae* and some species of *Mugilidae*) were reported from inland sites like Hatoula and Hayonim, suggesting that the Natufians preserved (probably by drying) and transported fish (Lernau & Lernau, 1994, pp. 114–120, Table 2).

### The Natufian Fishhooks

To date, six Natufian sites produced 44 fishhooks (Table 2, Figures 1–3). These include both settlement and mortuary sites, suggesting that fishhooks travelled between the mundane to the sacred and were part of the burial paraphernalia that accompanied some of the deceased. However, two settlement sites are responsible for the vast majority of the fishhooks (ca. 80%): Eynan (n > 17) and Jordan River Dureijat (n = 18), both located in the Hula Valley. Eynan and Jordan River Dureijat are also the Natufian sites with the most substantial corpus of fish remains (Borvon et al., 2018; Pedergrana et al., 2021). These two sites that stand out may represent sites where fishing played a more central role compared with other Natufian sites.

Morphologically, all Natufian hooks have a J-shaped form, with a typical long shank, an arched base and a shorter point (see also Pedergrana et al., 2021, fig. 5), and may also have knobs and barbs located on different parts. Measurable specimens range in length between 13.8 and 51.3 mm and width between 6.0 and 21.3 mm. The angle between the point and the shank is usually around 45°. These differences affect a hook’s strength and durability; the narrower the gap, the more durable a hook (Leach, 2006; Olson et al., 2008). The second noteworthy variability pertains to the presence of barbs and their position on the hook. The barbs can appear on the hook base’s edge (Figure 2:1–2 and possibly Figure 2:3), at the point (Figure 2:1) and along the shank (Figure 2:1–3). The different positions relate to specific functions. On the point and base, the barb probably reinforced the hook’s hold on the

**Table 1.** Natufian sites with fish remains.

Geographic location	Site	Aquatic habitat close to the site	N fish remains	Represented fish families	Sieve gauge size (mm)	N Fish hooks	Reference
Syria	Baaz Rock Shelter		35	<i>Cyprinidae</i> , <i>Salmonoid</i>	2.0		Napierala et al., 2013, table 2
Israel	Jordan River Dureijat	Lake	413	<i>Clariidae</i> , <i>Cyprinidae</i> , <i>Salmonoid</i>	2.0	18	Sharon et al., 2020; Pederagnana et al., 2021
	Eynan <sup>1</sup>	Lake	7,475	<i>Cichlidae</i> , <i>Clariidae</i> , <i>Cyprinidae</i> , <i>Salmonoid</i>	1.0–2.0	17+	Bouchud, 1987; Borvon et al., 2018; Valla et al., 2004, 2007
	Hayonim Cave	Stream	+	<i>Clariidae</i> , <i>Cyprinidae</i> , <i>Sparidae</i>	3.0		Belfer-Cohen, 1988, p. 459; Bar-Yosef Mayer & Zohar, 2010, table 2; A. Belfer-Cohen, pers. com.
	Hayonim Terrace <sup>2</sup>	Stream	23	<i>Cichlidae</i> , <i>Sparidae</i>	2.5	3	Boyd, 2012, p. 359; Munro, 2012, p. 329; Valla, 2012, p. 20
	Hilazon Tachtit Cave	Stream	+	<i>Cyprinidae</i> , <i>Mugilidae</i>	1.8		Bar-Yosef Mayer & Zohar, 2010, table 1; Goldgeir et al., 2019
	Nahal Ein Gev II	Lake	509	<i>Cyprinidae</i>	1.8		Munro et al., 2021
	Hof Shahaf <sup>3</sup>	Lake	+		1.0	1	Marder et al., 2013
Jordan Israel	Iraq ed-Dubb	Stream	+		2.0		Edwards & Martin, 2007, table 1
	Raqefet Cave	Stream	+		1.0	1	Nadel et al., 2008, 2012
	El-Wad Terrace	Stream	+	<i>Mugilidae</i> , <i>Mullidae</i> , <i>Serranidae</i> , <i>Sparidae</i>	1.0		Valla et al., 1986
	Kebara	Stream	3	<i>Sparidae</i>	?	4	Bar-Yosef Mayer & Zohar, 2010, table 2; Campana, 1989, pp. 101–102; Turville-Petre, 1932
	Hatoula	Stream	26	<i>Mugilidae</i> , <i>Sciaenidae</i> , <i>Serranidae</i> , <i>Sparidae</i>	0.5–1.0		Lernau & Lernau, 1994, p. 111, table 2

<sup>1</sup>The number of fish remains is based on Structure 228 (Borvon et al., 2018).

<sup>2</sup>Only part of the fish assemblage was analyzed (Munro, 2012).

<sup>3</sup>Only clear archaeological horizons were sieved with a 1.0 mm sieve (Marder et al., 2013).

fish's jaw; on the shank, it probably facilitated tying the string's knot. The latter, however, is also achieved in many examples by forming a groove encircling the

shank's tip (Figure 2:2, 4, 14). The functionality of the groove is reinforced by one example, in which residues of plant fibers were identified (Pederagnana et al., 2021: fig. 10:b,c).

Save one suggested ivory hook from Kebara (Campana, 1989, pp. 101–102), fishhooks were seemingly produced of bones deriving from small mammals, birds or ungulates (e.g. Valla et al., 2004). The fishhooks were produced with varying techniques, including abrading, grinding, incision and shaving (see Campana, 1989, p. 41; Pederagnana et al., 2021 for suggestions regarding their production), and at Eynan, Valla et al. (2004, 2007) claimed that preforms were identified. In general, most of the use-wear marks were located at the base of the arc, and there are no clear use-wear at the points; this led Campana (1989, p. 103) to suggest that these were not used for fishing. Abrasion is noted on many fishhooks (e.g. Pederagnana et al., 2021, fig. 9b; Valla et al., 2004, 2007), and a few examples are polished, formed from fine finishing or use (Boyd, 2012, p. 359; Campana, 1989, pp. 101–102; Nadel et al., 2012, fig. 25g; Pederagnana et al., 2021, fig. 9b).

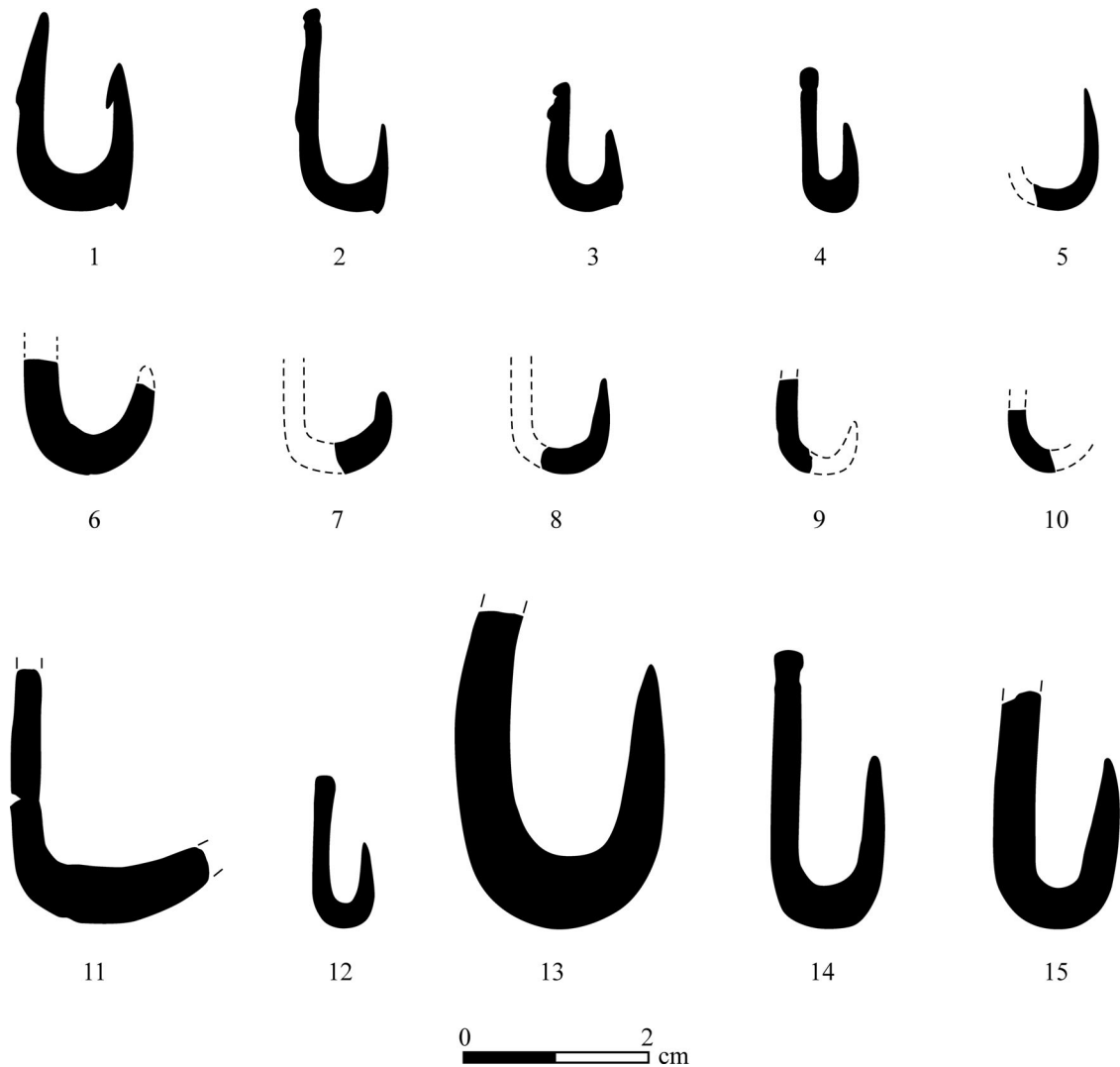
## Discussion

The ways in which people acquire food are part of the social act of acquiring and transforming the available resources (Boyd, 2005, p. 106). Fishing, today still one of the most popular food-obtaining methods,



**Figure 1.** Distribution map of Natufian sites with fish remains and fishhooks (Authors).





**Figure 2.** Natufian fish hooks. 1–4: Jordan River Dureijat (after Sharon et al., 2020, fig. 20a–d); 5–10: Eynan (Authors, after Valla et al., 2004, fig. 52:5, 2007, fig. 80:13–16); 11: Hof Shahaf (after Marder et al., 2013, fig. 17); 12: Raqefet (after Nadel et al., 2012, fig. 25g); 13–15: Kebara (after Turville-Petre, 1932, pl. XXVIII; Bar-Yosef Mayer & Zohar, 2010, fig. 3:12–13).

was practiced by hominins at least from the Middle Palaeolithic, using numerous technologies and strategies (e.g. Bertrando & McKenzie, 2011; Colaninno, 2011; Guimarães, 2013; Potts, 2012; Stewart, 1982; Von Brandt, 1972). These can be divided into high- and low fishing yields, which, in turn, may represent different attitudes toward the goals for fishing. While nets, traps and poison represent high-yield fishing strategies fishhooks signify low-yield strategies. Within this realm, the Natufian fishhooks seem to reflect a wish to control, and maybe limit, fish yields and apply a more modest and passive exploitation of the site's catchment area. This is of special note considering the Natufians were generally engaged in more intensive exploitation of their site's immediate catchment area (see e.g. Munro, 2004; Yeshurun et al., 2014; Yeshurun & Bar-Oz, 2018). Fishing, then, may have been part of a more limited activity, with only a supplementary contribution to the Natufian economy, even at sites where fish hooks were found.

Fishhooks are currently the only clear Natufian fishing gear supported by modern parallels, while harpoons, gorges and notched weights could have been used for several other functions and should not be associated exclusively with fishing. While notched weights may also reflect possible evidence for nets or trap fishing, they may have also been used as sinkers in line fishing (Rosenberg et al., 2016). The appearance of fishhooks in the Natufian is thus not trivial, although the Natufian hunter-gatherers were responsible for other technological novelties (e.g. stone construction, ground stone tools, bone tools among which harvesting tools), reflecting environmental and social adaptations (e.g. Bar-Yosef, 1983; Belfer-Cohen & Bar-Yosef, 2000; Perrot, 1966; Rosenberg & Chasan, 2021). These fishhooks appeared slightly after the first documented appearance of similar implements in East Timor (*ca.* 23,000–16,000 cal BP, see O'Connor et al., 2011) and more or less at the same time as their first appearance in Europe (*c.* 12,300 cal BP, see Gramsch et al., 2013).



**Figure 3.** Natufian hooks: 1: A fish hook from Kebara cave (photograph by L. Lachman); 2–8: Fish hooks from Jordan River Dureijat (after Pedergnana et al., 2021, fig. 3) (Authors).

**Table 2.** Natufian sites with bone fishhooks.

Geographic location	Site	N fishhooks	Preservation	N with tying groove/knobs	N with barbs	Length (mm)	Width (mm)	The gap between the point and the shank (mm)	Production and use wear	Reference
Israel	Jordan River Dureijat	18	4 whole+?	2	3	13.8–51.3	6.3–17.4	3.3–9.9	Cut, scraping and grinding marks, striations and polish	Sharon et al., 2020; Pedergnana et al., 2021
	Eynan <sup>1</sup>	17+	Broken?	–	–	–	–	5.0–8.0	Polish	Valla et al., 2004, 2007
	Hayonim Terrace	3	Broken	–	–	–	–	–	Two are polished with cut and scratch marks	Boyd, 2012, p. 359
	Hof Shahaf	1	Broken	–	–	–	–	–	–	Marder et al., 2013
	Raqefet Cave	1	whole	1	–	17.0	8.0	3.7	–	Nadel et al., 2008, 2012
	Kebara <sup>2</sup>	4	2 whole and 2 broken	2	–	18.1–28.9	12.1–21.3	7.9–14.2	All are polished	Campana, 1989, pp. 101–102

<sup>1</sup>There may be more fishhook fragments.

<sup>2</sup>One of these is, apparently, made of ivory.

This raises several questions about the global spread of innovations and the conventional use of artefacts and their typo-morphological conventions that are outside the scope of this paper. The latter relates to fishhooks achieving their morphological optimum during this stage; the design was reliable and maintainable (Bleed, 1986, p. 738), reflecting a heavily formulated idea governed by various factors and constraints (Bleed, 1986; Suh, 1990; Tomka, 2001 and see also Hayden, 1998), including, for example, a need, functionality, traditions and adaptations.

The emergence of angling demonstrates highly specialized and goal-oriented fishing practices that differ from most fishing strategies and techniques in its ability to better control the yield. Fish and fishhooks are generally uncommon in the Natufian archaeological record (compared to other food sources and food-related technologies). Thus, we are left with the assumption that fish were secondary to other more cost-effective animals, such as mammals (Munro, 2004 and references therein). However, fish were probably perceived as an important supplement to the Natufian diet (e.g. Stiner & Munro, 2002; and

see also Bar-Yosef Mayer & Zohar, 2010) at least in some areas like the Hula region (Borvon et al., 2018; Pedergnana et al., 2021). Thus, while the compatibility between the Natufian fishhook's presence and numbers and the fish families represented in Natufian sites is unfortunately unclear, we can carefully postulate that based on the high frequency of fish and fishhooks in this area, compared to other Natufian sites, Hula Valley sites were the first to adopt or develop angling fishing techniques in this region. As there should be a direct correlation between the size and shape of the hooks and the targeted fish families and sizes (e.g. Radu, 2008, pp. 415–416), we may also assume that these developments were first and foremost adopted for freshwater fish, more specifically those that lived in the Hula Lake ca. 15,000 years ago (and see Pedergnana et al., 2021).

The pace of the evolutionary history of fishhooks is unknown as there are too many holes in the chronological schema. However, it is of note that in the Near East, we do not see a clear evolutionary typomorphological process leading toward the formation of the J-shaped fishhook design, hinting that these hooks reached their morphological optimum in a short amount of time. These were designed as part of an independent system, which contrasted with high-yield techniques (i.e. per fishing interval). While the nature of such a system is unclear, it is possible that angling was a subsidiary and supplementary system for obtaining fish.

While it is hard to prove or negate any of these assumptions at this point, it is clear that fishhooks represent yet another aspect of Natufian innovative and flexible behaviour that appeared in the southern Levant together with a plethora of economic and social inventions and innovations. If indeed these fishhooks relate to acquiring a limited catch, then we should seek the significance of their appearance not just in the general framework of the Natufian hunter-gatherer economy and technological advances, but rather as part of the new formulation of economic activities, linked to other notable transformations seen during the later parts of the Epipalaeolithic.

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## Disclosure Statement

No potential conflict of interest was reported by the author(s).

## Contribution

DR contributed to the conception and design of the study. DR and RC collected the data. DR and RC wrote the manuscript.

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